**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**REGION III**
**1650 Arch Street**
**Philadelphia, Pennsylvania 19103-2029**

Mr. Larry Lawson, Director
Division of Water Program Coordination
Virginia Department of Environmental Quality
629 Main Street
Richmond, VA 23219

Dear Mr. Lawson:

The Environmental Protection Agency (EPA) Region III is pleased to approve the Total Maximum Daily Load (TMDL) report for the primary contact use (bacteria) impairment on Falling River. The TMDL report was submitted to EPA for review in April 2004. The TMDL was established and submitted in accordance with Section 303(d)(1)(c) and (2) of the Clean Water Act to address an impairment of water quality as identified in Virginia's 1998 Section 303(d) list.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) designed to attain and maintain the applicable water quality standards, (2) include a total allowable loading and as appropriate, wasteload allocations (WLAs) for point sources and load allocations for nonpoint sources, (3) consider the impacts of background pollutant contributions, (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated), (5) consider seasonal variations, (6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and instream water quality), (7) consider reasonable assurance that the TMDL can be met, and (8) be subject to public participation. The enclosure to this letter describes how the TMDL for the primary contact use impairment satisfies each of these requirements.

Following the approval of the TMDL, Virginia shall incorporate the TMDL into an appropriate Water Quality Management Plan pursuant to 40 CFR § 130.7(d)(2). As you know, all new or revised National Pollutant Discharge Elimination System permits must be consistent with the TMDL WLA pursuant to 40 CFR §122.44 (d)(1)(vii)(B). Please submit all such permits to EPA for review as per EPA's letter dated October 1, 1998.

If you have any questions or comments concerning this letter, please don't hesitate to contact Mr. Thomas Henry at (215) 814-5752.

Sincerely,

Jon M. Capacasa, Director
Water Protection Division

Enclosure

**Decision Rationale**

**Total Maximum Daily Loads for**
**the Primary Contact Use (Bacteriological) Impairments on Falling River**

## I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies identified as impaired by a state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (MOS), that may be discharged to a water quality-limited water body.

This document will set forth the Environmental Protection Agency's (EPA's) rationale for approving the TMDL for the primary contact use (bacteriological) impairment on Falling River. EPA's rationale is based on the determination that the TMDL meets the following eight regulatory conditions pursuant to 40 CFR §130.

1) The TMDL is designed to implement applicable water quality standards.
2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.
3) The TMDL considers the impacts of background pollutant contributions.
4) The TMDL considers critical environmental conditions.
5) The TMDL considers seasonal environmental variations.
6) The TMDL includes a margin of safety.
7) There is reasonable assurance that the TMDL can be met.
8) The TMDL has been subject to public participation.

## II. Background

The Falling River Watershed is located in Appomattox and Campbell Counties within the Roanoke River Basin. There are four impaired segments of Falling River. The most upstream impairment begins at the confluence of the North and South Forks of Falling River and extends to the mouth of Mollys Creek, the next impairment begins at the mouth of Little Falling River and ends at the Dan River Inc. water intake, the next begins at the Dan River water inteake and terminates at the Brookneal Lagoon, the last segment is from the lagoon to the mouth of Falling River. The 151,000-acre watershed is rural with forested and agricultural lands making up 70 and 28 percent of the watershed respectively. Developed lands account for approximately 1 percent of the total watershed area. There are seven point sources in the watershed.

In response to Section 303(d) of the CWA, the Virginia Department of Environmental Quality (VADEQ) listed 7.63 miles of Falling River (VAC-L34R) on Virginia's 1998 Section

303(d) list as being unable to attain its primary contact use. The listing was split between into three segments. These segments were listed on the 2002 Section 303(d) lists as well. The 2.86 mile Upper segment of Falling River was added to the 2002 Section 303(d) List. According to the 2002 Section 303(d) List Falling River is impaired over a 10.50 mile stretch. The decisions to list these segments of Falling River were based on observed violations of the Commonwealth's bacteriological criteria. At the time of its listing, the bacteria criteria used fecal coliform as an indicator species and had an instantaneous standard 1,000 colony forming units (cfu) per 100 milliliters (ml) and geometric mean standard of 200 cfu/100ml. This decision rationale will address the TMDL for the impairment of the primary contact use.

Fecal coliform is a bacterium which can be found within the intestinal tract of all warm blooded animals. Fecal coliform in itself is not a pathogenic organism. However, fecal coliform indicates the presence of fecal wastes and the potential for the existence of other pathogenic bacteria. The higher concentrations of fecal coliform indicate the elevated likelihood of increased pathogenic organisms.

EPA encouraged the states to use e-coli and enterococci as the indicator species instead of fecal coliform. A better correlation was drawn between the concentrations of e-coli and enterococci, and the incidence of gastrointestinal illness. The Commonwealth adopted e-coli and enterococci criteria in January 2003. According to the new criteria, streams will be evaluated via the e-coli and enterococci criteria after 12 samples have been collected using these indicator species. Twelve e-coli samples were collected from Falling River.

As Virginia designates all of its waters for primary contact, all waters are required to meet the bacteriological standard for primary contact. Virginia's standard applied to all streams designated as primary contact for all flows. The e-coli criteria requires a geometric mean concentration of 126 cfu/100ml of water with no sample exceeding 235 cfu/100 ml of water. Unlike the new fecal coliform criteria, which allows a 10% violation rate, the new e-coli criteria requires the concentration of e-coli to not exceed 235 cfu/ 100ml of water.

Although the TMDL and criteria require the 235 cfu/100 ml of water concentration limit not be exceeded, waters are not placed on the Section 303(d) list if their violation rate does not exceed 10%. Therefore, Falling River may be deemed as attaining its primary contact use prior to the implementation of all of the TMDL reductions. It is necessary to keep this in mind because of the reductions required to attain the instantaneous criteria for e-coli according to the model.

The TMDL submitted by Virginia is designed to determine the acceptable load of e-coli which can be delivered to the impaired water, as demonstrated by the Hydrologic Simulation Program Fortran (HSPF)[1], in order to ensure that the water quality standard is attained and

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[1]Bicknell, B.R., J.C. Imhoff, J.L. Little, and R.C. Johanson. 1993. Hydrologic Simulation Program-FORTRAN (HSPF): User's Manual for release 10.0. EPA 600/3-84-066. U.S. Environmental Protection Agency, Environmental Research Laboratory, Athens, GA.

maintained. HSPF is considered an appropriate model to analyze the impaired water because of its dynamic ability to simulate both watershed loading and receiving water quality over a wide range of conditions. The model was run to determine the fecal coliform loading to Falling River and the loads were then changed to e-coli using a conversion factor established by the Commonwealth.

The TMDL analysis allocates the application/deposition of fecal coliform to land based and instream sources. For land based sources, the HSPF model accounts for the buildup and washoff of pollutants from these areas. Buildup (accumulation) refers to all of the complex spectrum of dry-weather processes that deposit or remove (die-off) pollutants between storms.[2] Washoff is the removal of fecal coliform which occurs as a result of runoff associated with storm events. These two processes allow the HSPF model to determine the amount of fecal coliform from land based sources which is reaching the stream. Point sources and wastes deposited directly to the stream are treated as direct deposits. Wastes which are deposited directly to the stream do not need a transport mechanism.

Local rainfall and temperature data were needed to develop the model. Weather data provides the rainfall data which drives the TMDL model. Hourly weather data was obtained from the Lynchburg Airport and John H. Kerr dam weather stations. The data were combined and distanced weighted for use in the model.

Stream flow data was available for Falling River, therefore, the hydrology model was calibrated to the observed flow collected at a United States Geological Survey (USGS) gage 2064000 near Naruna. The calibration period for the model was from January 1997 through December 1998. During the calibration the model parameters were adjusted to allow the model to more accurately represent the observed data. When a satisfactory simulation was developed it was validated to a different data set of observed flow. The validation period for the model was from January 1996 through December 1996. During the validation the parameters were held constant to insure that the model accurately reflected the stream. The model replicated the observed gage data reasonably well during the calibration and validation. The simulation did not accurately reflect the observed storm flow data, as it was unable to reflect the processes associated with Hurricane Fran.

The HSPF model was next set-up to predict the water quality of Falling River. The model was calibrated against water quality monitoring data collected from station 4-AFR002.78 on Falling River. This monitoring was chosen because it had the largest data set, the calibration was conducted against observed data from January 1999 through December of 2000. The model seems to have overestimated the loadings to the stream as both the simulated geometric mean and violation rate are greater than the observed data indicates. It should be noted that the model is predicting daily averages and compared to instantaneous samples.

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[2]CH2MHILL, 2000. Fecal Coliform TMDL Development for Cedar, Hall, Byers, and Hutton Creeks Virginia,

Through the development of this and other similar TMDLs, it was discovered that natural conditions (wildlife contributions to the streams) could cause or contribute to violations of the bacteria criteria. Bacterial source tracking (BST) sampling data collected on Falling River indicated that bacteria from wildlife represents a significant portion of the bacterial load. In some instances the loads from wildlife alone appear to violate the numeric criteria. Many of Virginia's TMDLs, including the TMDL for Falling River, have called for some reduction in the amount of wildlife contributions to the impacted streams. EPA believes that a significant reduction in wildlife is not practical and will not be necessary due to the implementation plan discussed below. It should be noted that in order for Falling River to be in compliance approximately 90 percent of time, an 5 percent load reduction is required from wildlife sources. . This would be the violation rate necessary for the water to be assessed as attaining criteria for 303(d) listing purposes.

A phased implementation plan will be developed for all streams in which the TMDL calls for reductions in wildlife. In Phase 1 of the implementation, the Commonwealth will begin implementing the reductions (other than wildlife) called for in the TMDL. In Phase 2, which can occur concurrently to Phase 1, the Commonwealth will consider addressing its standards to accommodate this natural loading condition. The Commonwealth has indicated that during Phase 2, it may develop a Use Attainability Analysis (UAA) for streams with wildlife reductions which are not used for frequent bathing. Depending upon the result of the UAA, it is possible that these streams could be designated for secondary contact.

After the completion of Phase 1 of the implementation plan, the Commonwealth will monitor the stream to determine if the wildlife reductions are actually necessary, as the violation level associated with the wildlife loading may be smaller than the percent error of the model. In Phase 3, the Commonwealth will investigate the sampling data to determine if further load reductions are needed in order for these waters to attain standards. If the load reductions and/or the new application of standards allow the stream to attain standards, then no additional work is warranted. However, if standards are still not being attained after the implementation of Phases 1 and 2, further work and reductions will be warranted.

The TMDL was modeled using fecal coliform loading rates, as was done in previous TMDL efforts. The fecal coliform concentrations were then converted to E-coli concentrations using a translator equation developed by VADEQ. Significant reductions in the modeled load were required in order for Falling River to attain the new e-coli criteria in the model. More stringent reductions were required to meet the instantaneous standard than the geometric mean. Only one TMDL equation was developed since the reductions are so stringent and will be required universally. The equation was established for the most downstream segment.

Table 1 - Summarizes the Specific Elements of the TMDL.

| Segment | Parameter | TMDL (cfu/yr) | WLA (cfu/yr) | LA (cfu/yr) | MOS |
|---|---|---|---|---|---|
| Falling River | E-Coli | 1.04E+14 | 9.05E+11 | 1.04E+14 | Implicit |

The United States Fish and Wildlife Service has been provided with copy of this TMDL.

## III. Discussion of Regulatory Conditions

EPA finds that Virginia has provided sufficient information to meet all of the eight basic requirements for establishing a primary contact (bacteriological) impairment TMDL for Falling River. EPA is therefore approving this TMDL. EPA's approval is outlined according to the regulatory requirements listed below.

*1) The TMDL is designed to meet the applicable water quality standards.*

Virginia has indicated that excessive levels of fecal coliform due to nonpoint sources (both wet weather and directly deposited nonpoint sources) have caused violations of the water quality criteria and designated uses in Falling River. The water quality criterion for fecal coliform was a geometric mean 200 cfu/100ml or an instantaneous standard of no more than 1,000 cfu/100ml. Two or more samples over a 30 day period are required for the geometric mean standard. Since the state rarely collects more than one sample over a thirty-day period, most of the samples were measured against the instantaneous standard. Approximately 23 percent of the samples collected from the four monitoring stations on Falling River violated the applicable criteria.

The Commonwealth has changed its bacteriological criteria as indicated above. The new criteria require that the fecal coliform concentration not exceed a geometric mean of 200 cfu per 100 milliliters of water for two or more samples collected over a month nor shall more than 10 percent of the total samples exceed 400 cfu/100 ml of water. The new e-coli criteria requires a geometric mean of 126 cfu/100ml of water with no sample exceeding 235 cfu/100 ml. When the data is judged against the new criteria, the violation rate increases.

The HSPF model was used to determine the fecal coliform deposition rates to the land as well as loadings to the stream from direct deposit sources. Once the existing load was determined allocations were assigned to each source category to develop a loading pattern that would allow Falling River to support the e-coli water quality criterion and primary contact use. The following discussion is intended to describe how controls on the loading of e-coli to Falling River will ensure that the criterion is attained.

The TMDL modelers determined the fecal coliform production rates within the watershed. Data used in the model was obtained from a wide array of sources, including farm practices in the area, the amount and concentration of farm animals, animal access to the stream, wildlife in the watershed, wildlife fecal production rates, landuses, weather, stream geometry, etc.. The model combined all of the data to determine the hydrology and water quality of the stream.

The lands within the watershed were categorized into specific landuses. The landuses had specific loading rates and characteristics that were defined by the modelers. Therefore, the loading rates are different in lands defined as forested versus pasture. Pasture lands support

cattle and are influenced differently by stormwater runoff. The amount of cattle on the land, the time cattle spent on the land, and how much waste the cattle generated impacted the loading rate.

Local rainfall and temperature data were needed to develop the model. Hourly weather data was obtained from the Lynchburg Airport and John H. Kerr dam weather stations. This data was used to determine the precipitation rates in the watershed which transport the on land pollutants to the streams through overland and groundwater flows. Waste that was deposited to the land was subjected to a die-off rate. The longer fecal coliform stayed on the ground the greater the die-off was. Materials that were washed off the surface shortly after deposition were subjected to less die-off.

Stream flow data was available for Falling River, therefore, the hydrology model was calibrated to the observed flow collected at a United States Geological Survey (USGS) gage 2064000 near Naruna. The calibration period for the model was from January 1997 through December 1998. During the calibration the model parameters were adjusted to allow the model to more accurately represent the observed data. When a satisfactory simulation was developed it was validated to a different data set of observed flow. The validation period for the model was from January 1996 through December 1996. During the validation the parameters were held constant to insure that the model accurately reflected the stream. The model replicated the observed gage data reasonably well during the calibration and validation. The simulation did not accurately reflect the observed storm flow data, as it was unable to reflect the processes associated with Hurricane Fran.

The HSPF model was next set-up to predict the water quality of Falling River. The model was calibrated against water quality monitoring data collected from station 4-AFR002.78 on Falling River. This monitoring was chosen because it had the largest data set, the calibration was conducted against observed data from January 1999 through December of 2000. The model seems to have overestimated the loadings to the stream as both the simulated geometric mean and violation rate are greater than the observed data indicates. The TMDL modelers adjusted the loading rates from the various land uses and direct deposit sources to determine what reductions were required to meet the applicable water quality criteria. It was determined that in addition to almost the complete removal of anthropogenic sources, a 50 percent reduction was needed in direct deposit of wastes from wildlife.

*2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.*

Total Allowable Loads

Virginia indicates that the total allowable loading is the sum of the loads allocated to land based precipitation driven nonpoint source areas (forest and agricultural land segments) and point sources. Activities that increase the levels of bacteria to the land surface or their availability to runoff are considered flux sources. The actual value for total loading can be found in Table 1 of this document. The total allowable load is calculated on an annual basis.

Waste Load Allocations

There are seven facilities within the Falling River watershed that are permitted to discharge into the stream. Five of these facilities are allowed to discharge e-coli into Falling River. All of these facilities have individual permits, their WLA can be determined by multiplying their design flow by the bacterial concentration allowed in their discharge by 365 after the appropriate unit conversions. All of the facilities are allowed to discharge effluent with an e-coli concentration of 126 cfu/100ml, which is the water quality criteria for e-coli. These facilities can not cause a violation of the criteria if they are discharging at or below the criteria. The facilities are in all likelihood discharging below this concentration. The other facility is controlled by an individual permit which allows it to discharge 10,000 gallons of effluent per day with an e-coli concentration of 126 cfu/100ml. Table 2 lists the WLAs for these facilities.

EPA regulations require that an approvable TMDL include individual waste load allocations (WLAs) for each point source. According to 40 CFR 122.44(d)(1)(vii)(B), "Effluent limits developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA pursuant to 40 CFR 130.7." Furthermore, EPA has authority to object to the issuance of any National Pollutant Discharge Elimination System (NPDES) permit that is inconsistent with the WLAs established for that point source.

Table 2 - WLAs for the Falling River

| Facility | Permit Number | WLA (cfu/yr) |
|---|---|---|
| Appomattox Sewage Treatment Plant | VA0020249 | 2.95E+11 |
| Town of Brookneal Lagoon | VA0022250 | 1.43E+11 |
| Department of Corrections Rustburg | VA0023396 | 4.87E+10 |
| Thousand Trails Lynchburg Preserve | VA0068543 | 6.89E+10 |
| Rustburg Waste Water Treatment Plant | VA0023965 | 3.48E+11 |

Load Allocations

According to Federal regulations at 40 CFR 130.2(g), load allocations (LAs) are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading. Wherever possible, natural and nonpoint source loads should be distinguished.

In order to accurately simulate landscape processes and nonpoint source loadings, VADEQ used the HSPF model to represent the impaired watershed. The HSPF model is a

comprehensive modeling system for the simulation of watershed hydrology, point and nonpoint source loadings, and receiving water quality. HSPF uses precipitation data for continuous and storm event simulation to determine total loading to the impaired segments from the various landuses within the watershed. Table 3 lists the LAs for Falling River. The reductions needed to insure that the instantaneous criteria is attained at all times is extremely stringent. If the 10 percent violation rate required for a water to be placed on the Section 303(d) list was used the reductions to wildlife direct deposit would be 5 percent.

Table 3a - LA for Bacteria (fecal coliform) for Falling River

| Source Category | Existing Load (cfu/yr) | Proposed Load (cfu/yr) | Percent Reduction |
|---|---|---|---|
| Livestock Direct Deposit | 4.51E+13 | 0.00 | 100 |
| Wildlife Direct Deposit | 1.03E+14 | 5.43E+13 | 47 |
| Failed Septic Systems & Straight Pipes | 3.02E+11 | 0.0 | 100 |
| Developed | 4.94E+14 | 1.36E+13 | 97 |
| Cropland | 4.34E+13 | 1.19E+12 | 97 |
| Pasture | 1.25E+15 | 3.43E+13 | 97 |

| | | | |
|---|---|---|---|
| Forest | 1.94E+13 | 5.34E+11 | 97 |

*3) The TMDL considers the impacts of background pollution.*

The TMDL considers the impact of background pollutants by considering the bacteria load from background sources like wildlife.

*4) The TMDL considers critical environmental conditions.*

According to EPA's regulation 40 CFR 130.7 (c)(1), TMDLs are required to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of Falling River is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards[3]. Critical conditions are a combination of environmental factors (e.g., flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

The HSPF model was run over a multi-year period to insure that it accounted for a wide range of climatic conditions. The allocations developed in the TMDL will therefore insure that the criteria is attained over a wide range of environmental conditions including wet and dry weather conditions.

*5) The TMDL considers seasonal environmental variations.*

Seasonal variations involve changes in stream flow and loadings as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flows normally occur in early spring from snow melt and spring rain, while seasonally low flows typically occur during the warmer summer and early fall drought periods.

Bacteria loadings also change during the year based on crop cycles, waste application

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[3]EPA memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Management Division Directors, August 9, 1999.

rates, and cattle access patterns. Consistent with our discussion regarding critical conditions, the HSPF model and TMDL analysis effectively considered seasonal environmental variations through the use of observed weather data over an extended period of time and by modifying waste application rates, crop cycles, and livestock practices.

*6) The TMDL includes a margin of safety.*

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. The MOS may be implicit, built into the modeling process by using conservative modeling assumptions, or explicit, taken as a percentage of the WLA, LA, or TMDL. Virginia included an implicit MOS in the TMDL through the use of conservative modeling assumptions in the determination of bacteria loadings and production.

*7) There is a reasonable assurance that the TMDL can be met.*

EPA requires that there be a reasonable assurance that the TMDLs can be implemented. WLAs will be implemented through the NPDES permit process. According to 40 CFR 122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

Nonpoint source controls to achieve LAs can be implemented through a number of existing programs such as Section 319 of the CWA, commonly referred to as the Nonpoint Source Program.

*8) The TMDL has been subject to public participation.*

Two public meetings were held during the development of the TMDL. Both meetings were held in the Town of Brookneal, Virginia. The meetings were held on October 22, 2003 and February 24, 2004. The meetings were attended by 14 and 20 individuals respectively. All of the meetings were announced in the Virginia Register and opened to a thirty-day comment period. No written comments were received in relation to the TMDL.